Organizational knowledge, learning and memory: three concepts in search of a theory

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Introduction
There is growing interest in organizational knowledge, and in the associated concepts of organizational learning and memory (Cohen and Sproull, 1991). Many argue that the organization's knowledge and learning capabilities are the main source of its competitive advantage (e.g. Kogut and Zander, 1992; Prahalad and Hamel, 1990; Starbuck, 1992). But a number of other authors (Bedeian, 1986; Fiol and Lyles, 1985; Huber, 1991; Shrivastava, 1983; Walsh and Ungson, 1991) have argued that the literature is fragmented and that these concepts, while interesting, need considerable refinement before they can be of real consequence to practitioners or organizational theorists. This article offers a pluralist epistemology which pulls these ideas together and implies a theory of the firm as a system of knowledge types and processes.

In the first section it is argued that the underlying conceptual problem is that most of the contemporary organizational learning literature is narrowly positivistic. In the second section, a pluralistic epistemology embracing both positivistic and interpretive positions are developed. The article extends the classical distinctions between: the explicit and implicit types of knowledge; and the individual and social levels of analysis to a two-by-two matrix of knowledge types. Each implies a different mode of learning and memorizing. The third section discusses how these types of knowledge may be contrasted and measured, as well as exploring the interactions between them. The final section touches on management's opportunities to shape the firm as a system of knowledge, learning and memorizing processes.

Fragmentation and the positivist legacy
The knowledge, learning and memorizing literatures are inconsistent in many ways. Fiol and Lyles (1985) argued that the organizational learning literature actually covered two distinct concepts, cognitive learning or behavioural learning. Daft and Huber (1987) noted two perspectives, one “systems-structural” the other “interpretive”, and that organizational learning can take place in either. Huber (1991, p. 89), skirting Fiol and Lyles's point and invoking the notion of “potential behaviour”, argued that organizational learning comprised both behavioural and cognitive dimensions. Weick (1991, p. 116) warned us that organizational theorists took up the notion of learning at...
around the same time that psychologists began to abandon it. He went on to argue that learning should be framed in terms of the relationship between a stimulus and the actor’s response. This leads to the counter-intuitive conclusion that responding to a new stimulus may not be learning, since it is not clear that the response is based on new knowledge. The response may be based on knowledge derived from some other situation and memorized. Hence, Weick (1991) argued that learning must be defined as a changed response to the same stimulus. This defined learning as the displacement of what was known previously rather than the development of something new.

With this model there is the problem of creating the initial body of knowledge that made learning possible. The notion of absorptive capacity (Cohen and Levinthal, 1990), more familiar perhaps as a computer’s “boot” program, is a modern reference to this problem. Plato, of course, argued that learning is the process of uncovering what we already know, though at some preconscious level. The implication is that there are several different types of knowledge, some conscious some preconscious. These allusions to works other than Cyert and March (1963), March and Olsen (1976) and Argyris and Schön (1978), the references which dominate and define today’s organizational learning literature, suggest that some of the deeper problems may have been understood for some time. Perhaps much of what was understood about knowledge and learning in philosophy and psychology has been overlooked in the recent organizational literature. Indeed, the prevailing notion of knowledge seems naively positivistic and that of learning simplistically mechanical. We seem to presume that knowledge is made up of discrete and transferable granules of understanding about reality which can be added to an extant heap of knowledge.

No modern epistemologists hold this view. Following Wittgenstein, they presuppose knowledge comprises theoretical statements whose meanings and practical implications depend on their use and on the framework in which they are deployed (e.g. Horwich, 1993, p. 2). These days knowledge is less about truth and reason and more about the practice of intervening knowledgeably and purposefully in the world. This seems especially appropriate in the case of organizational knowledge, for organizations must surely be defined as systems of purposive activity. Wittgenstein’s attention to praxis threatens any model of objective knowledge which assumes that knowledge that can be abstracted from the processes of its discovery and application. Such “objectified” knowledge may well exist and be stored in libraries or on dynamic random access memory chips, but we must also understand how such knowledge can become reattached to and embedded in the ongoing processes of the organization.

Walsh and Ungson (1991) undertook an extensive examination of the organizational memory literature. Starting from the premise that organizations process information, they concluded that organizations must also have memory, though not necessarily of a type that matches either human or computer memory. Some have suggested that organizational memory
Organizational knowledge comprises standard operating procedures (March and Simon, 1958) or routines (Nelson and Winter, 1982, p. 99). Others have paid more attention to the organization’s culture (Barney, 1986, Pfeffer, 1981) as the repository of its knowledge. Yet others have looked to the organization’s artifacts, physical architecture, stories, heroes, and formal and informal structures as types of organizational memory. Clearly there is the possibility of categorizing organizational knowledge and the modes of organizational learning in terms of the different types of memory. Organizational memory, Walsh and Ungson (1991, p. 64) suggested, had to be fashioned in ways that reflected the knowledge stored. They went on to model organizational memory as six “storage bins”: individuals, culture, transformations, structure, ecology and external archives. This was reasonably eclectic, capable of grasping most of the ways in which others have previously thought about organizational memory. But it too implied a narrow positivistic concept of knowledge, the presumption that memory reflects knowledge’s separability from both the processes of its discovery and from the processes of its reattachment during implementation. Walsh and Ungson (1991, p. 63) concluded that it was theoretically possible for “all of the information relating to a decision stimulus and response to be part of an organization’s memory”. Following Wittgenstein’s recognition that the ultimate reason for applying a rule cannot be itself a rule, we would argue, contrary to Walsh and Ungson, that part of what is required to reattach the knowledge stored in memory must always lie outside this memory system, just as the process that transfers data to memory must also lie outside. A computer memory is only useful when it serves a CPU capable of storing and retrieving data. Thus, memory can only serve intelligence, it is not itself intelligence, and the concept of intelligence must always go beyond that of memory. Intelligence must include both the ability to experience and the facility to abstract from that experience, i.e. to create knowledge and learn what can be memorized. In short, memory cannot be understood without an understanding of the intelligence it serves.

The relationship between data and information is not completely obvious. In an uncertain, non-positivistic world, where there is no privileged access to truth, there are always problems of meaning. While data can be defined as that which can be communicated and stored, meaning cannot be stored unless it is rendered unproblematic - which is when data are treated as fact. Under the conditions of uncertainty which typically prevail in organizations, and in human affairs generally, a theory of meaning as well as a theory of learning is required to make sense of the concept of memory. Intelligence then encompasses both the creation and processing of data, as well as its interpretation or meaning. Without a theory of intelligence it is not possible to understand memory. In short, we posit two radically different kinds of organizational knowledge, data and meaning, each generated, stored and applied in completely different ways, while intelligence shapes, and is shaped by, their interaction.
At this stage we can conclude that the fragmentation of the literature is the result of the two methodological manoeuvres institutionalized into the contemporary analysis of organizational knowledge. The first separates the notions of knowledge, learning and memory, presuming each can be treated independently. But we see the three concepts are interdependent parts of a single system of ideas about organizations and their knowledge processes, just as, in Ohm's Law, voltage, current and resistance comprise a single system of concepts about electricity and can only be understood in terms of each other. This triangle of interdependency and interdefinition is the foundation on which the rest of the organizational system must be built.

Yet we have no more robust definition of knowledge than that suggested by the term asset. Clearly, knowledge can sometimes be treated as a simple asset, and much of the discussion about appropriability, intellectual property rights, and the returns to R&D investments reflects this conviction. But the definition leaves us powerless to deal with those aspects of knowledge that seem to differ significantly from our intuitive ideas about assets and the way they behave. One is that knowledge often seems to be a “non-rivalrous” or “public” good, one whose quantity and value is not diminished by sharing it with others. This is less true if we insist on measuring knowledge by the monopoly rents that it earns rather than in terms of the changes it can lead to (to recall Weick's (1991) definition of learning). A purely economic analysis might overlook those aspects of knowledge that seem to be inconsistent with an asset-based definition, with its implicit conservation or constancy in quantity. Creativity adds knowledge, extends and reshapes what was previously known. Assets, as resources, are compounded with knowledge about their use, knowledge of a different type. Here we touch on the limitations of knowledge as abstracted theory and see the field's second simplifying manoeuvre, its adoption of a positivist theory of knowledge. Given the degree to which organizational analysis is dominated by positivist methodologies, in spite of growing attention to interpretive systems, culture, organizational practices and postmodern critiques, this is none too surprising. But given the wholesale rejection of positivism by most philosophers of science, developmental psychologists, sociologists and others equally interested in the practical and social effects of learning, it may be time for us to be a little more open.

Following Weber and others, organization theorists (e.g. Ouchi, 1979; Williamson and Ouchi, 1981) have noted that the two concepts of organizational knowledge lead to different modes of governance and to different theories of organization and management. Much of today's literature is taken up with the transition from bureaucracy to other modes of organization, i.e. with a shift from control by data to control of meaning. But there is little consideration of the balance between these two interdependent types of knowledge. Thus, we argue that much of the confusion in the organizational knowledge, learning and memory literatures stems from attempts to simplify and consider them one by one rather than as interrelated parts of a single system. We also see that a full specification of this system and its dynamics would be a knowledge-based or
epistemological theory of the firm. There is a direct link between this rather abstract epistemological discourse and the practicalities of organization theory because of the intimate relationship between modes of managerial knowing and of control. In the next section we outline a theory of organizational knowledge and prepare the ground for a knowledge-based theory of the firm and its governance.

**A pluralistic epistemology**

The purpose of this section is to sketch an epistemological model which embraces several types of organizational knowledge. Much of this pluralism was anticipated in the Weberian distinctions between *wërtrationalität*, *zweckrationalität*, traditional and affective knowledge, by Simon’s distinction between facts and values, and by Ouchi’s (1979) separation of the objective knowledge of bureaucracies and the cultural knowledge of clans. Over the last few decades a number of organizational analysts have become interested in richer epistemologies which can address more complex notions of uncertainty than are admissible in a positivist framework. Polanyi’s (1962) work, and his distinction between objective and tacit knowledge, has become extremely influential. It underpins the work of Nelson and Winter (1982), of Nonaka (1994), and that of Hedlund (1992). Of course the distinction between objective and tacit knowledge is a restatement of James’s (1950, pp. 1-221) distinction between “knowledge about” and “knowledge of acquaintance”, i.e. that of which an actor has personal acquaintance. Tacit knowledge is defined variously as that which is gained experientially or, stressing the privacy of personal experience, in terms of its incommunicability. It is probably more informative to focus on tacit knowledge’s inseparability from the processes of its creation and application, and we shall define tacit knowledge as that which has not yet been abstracted from practice. Note that this definition modifies the distinction between the objective and the tacit, and makes it possible to consider traffic between them.

To stress practice is to risk generating confusion between tacit knowledge and the kind of kinetic knowledge exhibited by a ballet dancer. In fact the dancer might be applying explicit knowledge, able to report it in Laban notation just as a someone might draw a precise map of their route from home to office. Tacit knowledge is more like that being applied in the state of flow (Csikszentmihalyi and Csikszentmihalyi, 1988), knowledge of which the actor was not explicitly conscious and which does not need to be fitted into or processed through a conscious decision-making schema. The fact that an actor cannot articulate and communicate his or her tacit knowledge explicitly through language does not mean that it cannot be communicated in other ways. Apprentices were often taught without any formal instruction or even, as with the Japanese pottery masters, without any conversation. The term tacit must not be used as a form of mystification. Rather it must be an appeal to a form of knowledge with which we are all intimately familiar, the kind of knowledge we
pick up by “osmosis” when we join a new organization or take up a new activity, and on which our sense of domain mastery is based.

Goodenough (1971) defined culture as what one has to know in order to be taken by the natives as one of their own. To be acculturated is to be confident that one can act in this way. This notion of culture as confident activity draws attention to praxis rather than to abstract theorizing and it has a significant tacit component. Consider table manners. Most people are only slightly conscious of the way they conduct themselves while eating, yet most know objectively that their table manners are highly revealing and speak loudly to others. Similarly, when we say that an organization has a culture, we mean it evidences considerable tacit knowledge in its praxis. Tacit knowledge is evident as the institutionalized aspects of the organization’s activities. The knowledge has been transformed into habit, made traditional in the sense that no-one can explain it, it becomes “the way things are done around here”. Selznick (1957, p. 17) implied that it is the tacit component which infuses organizational activity with meaning beyond its function. Thus, the distinction discussed earlier between data and meaning maps directly into the distinction between explicit and tacit knowledge. The meaning of the explicit depends on its use, on how it is fitted into the complex tacit universe of social or organizational praxis.

To our analysis of the distinction between the explicit and the implicit types of knowledge we can add an analysis of the distinction between the individual and the organization. We have spoken as if organizational knowledge, learning and memory are functionally equivalent to and can be modelled on the individual’s knowledge, learning and memory functions. We cannot continue with this presupposition once we argue that the terms knowledge, learning and memory are interrelated aspects of a single system, for organizations and individuals are clearly not functionally equivalent. Organizations are artifacts, constructed for a purpose. Individuals are not. Nor can we map individualistic theories, psychological or economic, up to the organizational level while arguing, at the same time, that much of an individual’s knowledge is embedded in systems of social and personal practice. Organizational practices differ from those of individuals. Walsh and Ungson (1991, p. 61) saw the organization as the sum of the participating individuals’ knowledge. Summation produced a body of shared knowledge and meanings that, abstracted, externalized, memorized and made available to new members, could survive the departure of the original individuals. This is reasonable but not sufficient. While sharing may be important it treats the organization as little more than a library and communication system for the knowledge being generated and applied by individuals.

We must hold to a different view if we believe that the organization is capable of activities unlike those of individuals. Crowd behaviour is a well-known example where the collective seems to have a mind of its own, doing things that no-one in or out of the crowd comprehends or intends. Many regard the notion of collective mind as a troublesome construct. Walsh and Ungson noted that Durkheim (1964) proposed collective ways of thinking and acting that lay
outside the individuals who were the agents of these thoughts and actions. Durkheim's students, Fleck (1979) and Halbwachs (1992), considered cognizing and remembering to be collective activities. Walsh and Ungson (1991, p. 68) concluded that organizational memory was a capability spread across both individual and organizational levels. This was surely not what Durkheim implied. On the contrary, he argued that organizational properties had no correlate at the individual level and were not summations of individual capabilities, they were systemic properties that emerged unforeseen at the social level.

Weick and Roberts (1993) have recently reworked these Durkheimian ideas. Following Sandelands and Stablein (1987, p. 137) they argued that a system's collective properties emerge from interrelated social practice when these practices are conducted "mindfully" by the individual agents involved. Rather than being a summation of the capabilities of individual mind, collective mind calls for individuals' mindful attention to the system level consequences of each's contributing, representing and subordinating behaviour. Thus, collective mind lay between rather than within the participating individuals. It became evident as the individuals took action (contributed), while bearing the activity system in mind (representing) and subordinating themselves to the system. Many theorists, such as Douglas (1987) and Allport (1924), explicitly rejected Durkheim's conscience collective, maybe because it smacked of the Jungian collective unconscious. Others accepted it, albeit implicitly. Alchian and Demsetz (1972), for instance, argued that firms evolved as efficient economic institutions for the development and control of the "team production" which created a metering, monitoring and organization problem. Penrose (1959, p. 53), in her theory of the growth of the firm, argued that it was management's evolving skills in solving problems and combining resources that led to the surplus capabilities which propelled the firm to further growth. These capabilities were collective, at the system level and could not be evaluated in terms of, or as the sum of, the participants' capabilities.

Durkheim's argument was not that collectives think. On the contrary, it was an exploration of the social or collective nature of each socialized individual's thinking, learning and remembering processes. Thus, we cannot argue for knowledge capabilities at the organizational level without at the same time modifying our conception of such capabilities at the individual level. One contemporary form of this argument is social construction theory (Gergen, 1994), the idea that the individual's consciousness and thinking are fashioned socially. Durkheim's analysis was an attack on naive notions of individuality, such as those which assumed consciousness was a biological given which could be separated conceptually from the social context and process of developing a sense of self. In place of simplistic concepts of the abstracted individual, we need some theory about the relationship between the individual and social levels of thought which does not presuppose that every aspect of an individual's knowledge processes can be separated from its social context. Developmental psychologists, focusing on the development of the self in children, have
provided such a framework. Vygotsky (1962), in particular, provided an activity theory which had some similarity to the symbolic interactionist position outlined by Mead (1913). The main argument was that socially embedded activity preceded the development of individual consciousness. The Vygotskian model focused on the flow of knowledge and consciousness from the explicit at the social level to the implicit at the individual level through the process of internalization.

A more rigorous model, grounded in empirical psychology and in Vygotskian activity theory, was offered by Reber (1993). This focused on the flow from the implicit to the explicit rather than in the opposite direction. James's (1950) position was that knowledge was initially “of acquaintance” because it was acquired through direct experience. The task of the scientist was to make this knowledge explicit by abstracting it from the subjective context of experience. Reber's point was that there are both explicit and implicit processes in human thought, and these are related phylogenetically, i.e. the implicit processes were developed at an earlier stage in our social and biological evolution than the explicit processes. In this sense, the implicit can be defined as the domain of preconscious reasoning.

The argument recalls Husserl's concept of Lebenswelt, the pre-reflexive, pre-scientific, pre-philosophical world that nevertheless guides scientific and philosophical reflection. It was a direct contradiction of Simon's (1991, p. 47) argument that intuition is “analysis frozen into habit”, explicit individual reasoning internalized. Reber focused on the qualitative differences between pre-conscious and post-conscious reasoning arguing that flow between them involved two different modes of knowing and reflected an inherent evolutionary dynamic. These models are far from complete and have yet to be tested empirically. But they frame some of the ways in which the two dialectics interact. They illustrate how the knowledge types may hold together sufficiently for the concept of the organization as a system of knowledge processes to be meaningful.

The final step in structuring our pluralistic epistemology involves proposing dialectical relationships between both the explicit and implicit categories, between the individual and organizational categories and, reflecting the organization's underlying dynamism, between these two dialectics themselves. We can illustrate this as a two-by-two matrix as in Table I.

<table>
<thead>
<tr>
<th>Individual</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit</td>
<td>Conscious</td>
</tr>
<tr>
<td>Implicit</td>
<td>Automatic</td>
</tr>
</tbody>
</table>

The individual category presupposes independent consciousness. Socially explicit knowledge is evaluated according to institutionalized standards of
truth testing which, for the scientific community, produce a sense of objectification. Empirical psychologists have defined the knowledge which the individual accesses in a state of flow as automatic. A crucial instance of “automaticity” is the process of recognition which, as artificial intelligence and neurological research has revealed, has little to do with logical computation. Finally, the social implicit element of the individual’s knowledge processes is typically called collective (Halbwachs, 1992; Middleton and Edwards, 1990; Weick and Roberts, 1993).

Each of the quadrants implies a different model of how knowledge, learning and memory interact. The objectified quadrant is clearly strong on memory: libraries, data banks, standard operating procedures, rule-based production systems, and so forth. But there is no knowledge development here. Learning would mean only the processes of storage and retrieval, of adding to the library, creating the indexes, and withdrawing the books. The knowledge stored comes from elsewhere. Hence, our attention to the scientific method which “polices” the flow, telling us which ideas and books, emerging from the privacy of individual thought, are to be admitted into the public domain. Explicit memory systems are repositories, they store data rather than meaning and even falsified knowledge remains available, to be given meaning and used as considered appropriate.

The individual’s conscious memory is more problematic. Codified as a set of notes or a laboratory notebook, it is potentially available to others. Uncodified and unavailable, it may even slip away from its possessor when most needed. Clearly the boundary between conscious and automatic memory is imprecise, though much is now known about the biology of short-term memory and its differences from long-term memory. Learning also differs between the quadrants. Both James and Polanyi argued that the development of knowledge cannot be understood in terms of the explicit or the scientific method of analysis and hypothesis testing (trial and error) alone. The attachment of meaning, and the explication and codification of what is learned through practice and experience or learning by doing, must also be considered. Finally, learning at the collective level is the outcome of the interplay between the conscious and automatic types of knowledge, and between the individual and collective types of knowledge as they interact through the social processes of the collective, such as teamwork.

**Operationalizing and contrasting quadrants of the matrix**

Though there is patchy evidence for the notion of different types of human knowledge, we should be able to identify the different types of organizational knowledge. We should also note that the difference in knowledge types implies contrasting research methods, as would be the case if we compared and contrasted bureaucratic and clan knowledge. The best understood contrast is that between the interpretive and functionalist methods of social science. Even though Burrell and Morgan (1979, p. 22) stressed their underlying epistemological differences, there is an expanding literature of “triangulation”
(Jick, 1983) and qualitative methodology which denies their incommensurability (e.g. Miles and Huberman, 1994). Overlooking this leads us to ignore the crucial place of individual and collective practice in the development of the various types of knowledge. The failure to see the incommensurability on which Burrell and Morgan built their typology is additional evidence of the weak epistemological underpinnings of much contemporary organizational analysis. The two methods even have different objectives. The objective of positivist research is the development of a coherent abstract representation of the world out there, the presumed independent and seamless but knowable reality in which we are all embedded. The focus of interpretive research is on the ways in which we attach meaning to our experience. These programmes are only commensurate when experience reveals reality, when it provides privileged insight into the nature of the universe. The nature of perception, and the disjunction between the objective and subjective worlds, forbids this. To overlook the incommensurability of the positivist and interpretive programmes is to overlook the irrevocable uncertainties of the human condition and thereby everything that makes our knowing, learning and memorizing processes interesting.

The contrast between the research methods appropriate to the upper (explicit) quadrants of the matrix in Table I and those appropriate to the lower (implicit) quadrants maps the contrast between the positivist and interpretive methods. While positivism treats actors as objects whose behaviours can be observed by outsiders searching for general laws, interpretive methods focus on the subjective meanings attached to these behaviours. Researching the latter cannot mean collecting individuals' answers to explicit questions about these behaviours since the meaning of both the questions and the answers must remain as problematic as the meaning of the actions. We are threatened with endless regress when we search for underlying universal laws. Ethnographers have shown the essence of researching meaning is reflexive participation in the social behaviours from which meaning emerges and in which it is embedded. There is a relationship between researching meaning and participating in activity because meaning is implicit knowledge and is embedded in and communicated through activity.

However, the methodological contrast is not simply between the upper and lower halves of our matrix. It is also between the left-hand individual and right-hand organizational halves. The statements which comprise objectified knowledge are made by individuals. But the processes by which they are transformed into science are institutional. These processes infuse these statements with a meaning and status whose nature can only be revealed by participating in the process of science. Though there are other flows around the matrix, the principal process is the interaction between the individual's conscious activity and the collective's institutionalized practices (Figure 1).

The ethnographer struggles to explicate the experience of participating in others' behaviour and meaning systems. The manager, in contrast, struggles to transform explicit purposive statements into meaningful collective activity.
Each focuses on a different kind of knowledge and has a different interest in its production and use. Even this distinction is too coarse. Some firms might prefer one type of knowledge rather than another, much as IBM, DEC and Apple used to be taken as metaphors for the alternative approaches to computing. Some firms are strong on the creative skills of their members while others are explicitly calculative. Some are loosely coupled, the glue of collective practice holding them together, while others are highly structured and provide efficient communication between highly skilled individual role occupants. Following Penrose (1959), and Alchian and Demsetz (1972), there seems to be growing agreement, especially among those attracted to the resource-based theory of the firm (e.g. Amit and Schoemaker, 1993; Barney, 1991; Conner, 1991), that collective knowledge is the most powerful strategically. Indeed Spender (1995) has argued that different types of economic rent can be associated with different types of knowledge, that collective knowledge gives rise to “Penrose” rents while explicit knowledge gives rise to Pareto or monopoly rents. Collective knowledge comprises both meaning (cognitive, affective, symbolic and cultural) and praxis (behaviours, rituals and organizational routines). Being embedded, collective knowledge is both relatively immobile and historically contingent and, therefore, relatively inimitable. In contrast, the explicit conscious or objectified knowledge assets lead directly to appropriability problems.

**Management’s place in a knowledge-process theory of the firm**

We have argued that firms comprise four types of knowledge, and that these types interact; firms cannot be understood as actualization of objective knowledge alone; and firms can know, learn, and store of all four types of knowledge. We can learn about these notions from organizational distress and pathology. Organizations can, for a while, mismanage one or other types of knowledge and survive. Spender and Baumard (1995) conducted case studies on several firms that entered a period of strategic crisis as a result of losing their implicit knowledge and, thereby, their sense of identity and purpose.
They recovered through the activity of key individuals who reconstructed their implicit knowledge and praxis, or put such reconstruction in motion. In each case, the pattern of movement around the matrix of the firm’s dominant mode of knowing was similar (Figure 2). After the security of a stable pattern of self-regulating collective practice (step 1) was disturbed, the firm regressed to an earlier stage of being guided directly by others. Collective activity, wherein members are inner-motivated and mindful in their actions, is replaced by explicitly directed activity. Leaders take charge. But for the organization’s members life now becomes shaped by rules without meaning (step 2). The return to the collective involves dependence on an individual who supplies new meaning (step 3); and is typically preceded by a “pathological” stage, as those who had failed to sustain the pattern at step 1 attempt to restructure the firm bureaucratically on the basis of their objectified knowledge of the organization. This remedy invariably failed. After the transformational leader took control and found new meaning for the firm, the strategic agenda became the development of a new stable pattern of collective knowledge (step 4).

In the last two sections we sketched a theory of the firm as a system processing different kinds of knowledge. The firm comprises several distinct types of knowledge: conscious, objectified, automatic and collective. Each implies different learning and memory processes. The types interact dialectically to form an organic system with knowledge both at the level of the system and at the level of the individuals it embraces. System level knowledge, whether objectified or collective, is not autonomous, existing independently of the individual members. It is a reflection of the social aspects of the individuals’ consciousness. The two levels interact dialectically, constituting and reconstituting each other as suggested by structuration theory. Following Penrose (1959) and Alchian and Demsetz (1972), we argued...
that organizations are an evolved organic means to harness the creative properties of their participating members to the process of developing system level capabilities. While a firm comprises both individuals with conscious and automatic knowledge, learning and memory capabilities, and a set of definable objectified resources, its most strategically important feature is its body of collective knowledge. This knowledge is both situated (Suchman, 1987) and embedded in the organization as a community of practice (Brown and Duguid, 1991; Lave and Wenger, 1992). The key to management’s impact on the firm’s strategy is the influence they exert over the growth and shaping of this collective knowledge. Penrose (1971, p. 43) and Alchian and Demsetz (1972) treat this as central. Its effect is illustrated in Spender and Grinyer (1995) and in Spender and Baumard’s (1995) empirical research.

Conclusions
In this article a theory of the firm as a dynamic system of processes involving several different types of knowledge was outlined. We must have some such system in mind if we are to make sense of organizational knowledge, learning and memory, for they are interrelated parts of a single system. Like voltage, current and resistance, the terms knowledge, learning and memory must be defined in terms of each other, and are only meaningful in terms of particular practices. Mapping models based on individual psychology (or individual learning practice) on to the firm, may be wholly inappropriate. In the same way that the economists’ view of knowledge as a tradable asset misses much that is strategically important, so individualistic psychology misses the crucial collective properties of social and organizational systems. A richer epistemological approach, in which the various types of organizational knowledge and practice are considered both separately and in their interaction, could lead us towards more comprehensive and inclusive models.

While much of the discourse about organizational knowledge, learning and memory is abstract, we have shown that fundamental questions about the different types of knowledge and their interaction can be addressed empirically. We follow Wittgenstein and argue that the meaning of all knowledge is tied up with the context of its development and use, and that the notion of its objectification and detachment from the processes of its discovery and application is just another inhibiting element of positivism’s legacy. Our discipline’s rising interest in organizational knowledge, learning and memory presages a paradigm shift away from positivist epistemologies to those which focus directly on the social nature of meaning and practice. The firm itself is reconceptualized as a community of practice, with institutional dimensions that give these practices meaning, rather than as a system of tradable resources under the explicit control of senior managers (Spender and Grinyer, 1995). The resulting model is of a firm which is a dynamic, self-referring system only partially responsive to managerial influence.
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